

CLAIMS:

We claim:

1. An apparatus comprising:
two heat exchange members configured to be placed on both sides of a semiconductor module, the semiconductor module including a plurality of packages;
a connection member between the two heat exchange members configured to movably join the two heat exchange members, wherein portions of the two heat exchange members are configured to protrude above the semiconductor module; and
a biasing member disposed between the two heat exchange members and configured to provide a force that holds the two heat exchange members against the packages of the semiconductor module.
2. The apparatus of claim 1, wherein the connection member comprises a hinge.
3. The apparatus of claim 1, wherein the portions of the two heat exchange members have uneven surfaces.
4. The apparatus of claim 1, wherein the portions of the two heat exchange members comprise:
a metal plate having a porous surface.
5. The apparatus of claim 4, wherein the metal plate comprises an aluminum plate.
6. The apparatus of claim 1, wherein the biasing member is disposed between the portions of the two heat exchange members that protrude above the semiconductor module and is chosen from the group consisting of a spring, a plate spring, and a C-shaped spring.
7. The apparatus of claim 1, further comprising:
a thermal interface material layer formed on at least one of the heat exchange members and configured to contact a surface of the packages.

8. The apparatus of claim 7, wherein the thermal interface material layer is selected from the group consisting of a thermal tape, a thermal grease, a thermal epoxy, and a phase change material.

9. The apparatus of claim 7, wherein at least one of the two heat exchange members comprise a recess filled with the thermal interface material layer.

10. The apparatus of claim 7, wherein at least one of the two heat exchange members comprise a packing member bounding the thermal interface material layer.

11. The apparatus of claim 1, wherein at least one of the heat exchange members is subjected to surface processing selected from the group consisting of etching, sputtering, and coating.

12. An apparatus comprising:
a first heat exchange member including a first contacting portion, the first contacting portion configured to contact a surface of a semiconductor module to absorb heat generated by the semiconductor module, and a first heat dissipating portion, which is thermally connected to the first contacting portion to dissipate the heat absorbed by the first contacting portion;

a second heat exchange member including a second contacting portion, the second contacting portion configured to contact another surface of the semiconductor module to absorb the heat generated by the semiconductor module, and a second heat dissipating portion, which is thermally connected to the second contacting portion to dissipate the heat absorbed by the second contacting portion; and

an elastic member structured to provide a force that draws the first and second contacting portions toward each other.

13. The apparatus of claim 12, wherein the elastic member is a C-shaped spring having ends going through the first and second heat dissipating portions, the apparatus and that are connected to external surfaces of the first and second contacting portions and which

is oriented such that the connection portion is included in the space formed by the C-shaped spring.

14. The apparatus of claim 12, further comprising:

a connection member, which hinge joins the first and second heat exchange members such that the first and second heat dissipating portions protrude above the semiconductor module inserted between the heat exchange members, wherein the elastic member is chosen from the group consisting of a spring, a plate spring, and a C-shaped spring, and wherein the elastic member is disposed between the first and second heat dissipating portions.

15. The apparatus of claim 12, wherein the first and second contacting portions are subjected to surface processing selected from the group consisting of etching, sputtering, and coating, to increase the adhesion to the semiconductor module.

16. An apparatus comprising:

a first heat exchange member including a first contacting portion configured to contact a surface of a semiconductor module to absorb heat generated by the semiconductor module, and including a first heat dissipating portion with uneven surfaces, the first heat dissipating portion thermally connected to the first contacting portion to dissipate the heat absorbed by the first contacting portion, wherein the first heat dissipating portion is configured to protrude above the semiconductor module;

a second heat exchange member including a second contacting portion configured to contact another surface of the semiconductor module to absorb the heat generated by the semiconductor module, and including a second heat dissipating portion with uneven surface, the second heat dissipating portion thermally connected to the second contacting portion to dissipate the heat absorbed by the second contacting portion, the second heat dissipating portion configured to protrude above the semiconductor module;

a hinge that joins the first and second heat exchange members; and

a biasing member disposed between the first and second heat exchange members to provide a force that draws the first and second contacting portions toward the surface and the another surface of the semiconductor module that is inserted between the first and the second contacting portions.

17. The apparatus of claim 16, wherein the first and second heat dissipating portions are made of an aluminum plate with porous surfaces.

18. An apparatus comprising:

a first heat exchange member including a first contacting portion that is configured to contact a surface of a semiconductor module to absorb heat generated by the semiconductor module, and including a first heat dissipating portion that is thermally connected to the first contacting portion to dissipate the heat absorbed by the first contacting portion, wherein the first heat dissipating portion is configured to protrude above the semiconductor module;

a second heat exchange member including a second contacting portion that is configured to contact another surface of the semiconductor module to absorb the heat generated by the semiconductor module, and including a second heat dissipating portion that is thermally connected to the second contacting portion to dissipate the heat absorbed by the second contacting portion, wherein the second heat dissipating portion is configured to protrude above the semiconductor module;

a hinge that joins the first and second heat exchange units;

an elastic member disposed between the first and second heat exchange members to provide a force that draws the first and second contacting portions toward the surface and another surface of the semiconductor module inserted between the first and second contacting portions;

thermal interface material layers formed on the first and the second contacting portions; and

packing members bounding the thermal interface material layers.

19. The apparatus of claim 18, wherein the packing members comprise rubber packing members.

20. The apparatus of claim 18, wherein the first and second contacting portions comprise a recess filled with the corresponding thermal interface material layer.

21. The apparatus of claim 20, wherein each of the packing members is disposed around the corresponding recess.

22. A heat dissipater, comprising:
a relatively flat, elongated thermally conductive substrate; and
a clamp structured to hold a portion of the thermally conductive substrate adjacent to a top surface of one or more heat generating components that are attached to a circuit board.

23. The heat dissipater of claim 22, further comprising a second elongated thermally conductive substrate.

24. The heat dissipater of claim 23 wherein the clamp is structured to hold the first conductive substrate against a top surface of one or more heat generating components that are attached to a first side of the circuit board, and is structured to hold the second conductive substrate against a top surface of one or more heat generating components that are attached to a second side of the circuit board.

25. The heat dissipater of claim 23 wherein the clamp is a hinge clamp mounted between the first and second conductive substrates.

26. The heat dissipater of claim 22 wherein the clamp further comprises a biasing member.

27. The heat dissipater of claim 25 wherein the biasing member is one selected from the group of a spring, a plate spring, and a C-shaped spring.

28. The heat dissipater of claim 22 wherein the thermally conductive substrate is aluminum.

29. The heat dissipater of claim 22, further comprising a thermal interface material disposed on the thermally conductive substrate.

30. The heat dissipater of claim 28 wherein the thermal interface material is non-conductive.

31. A method of dissipating heat from two or more heat generating components mounted on opposite surfaces of a circuit board, the method comprising:
simultaneously clamping, to at least two opposed top surfaces of the heat generating components, portions of a first and a second elongated thermally conductive substrate, respectively.

32. The method of claim 31 wherein clamping comprises:
temporarily overcoming a normal biasing force to separate the first and second elongated substrates;
positioning portions of the first and second elongated substrates over the at least two opposed top surfaces, respectively; and
releasing the temporarily applied force to cause the normal biasing force to hold the first and second elongated substrates adjacent to the at least two opposed top surfaces, respectively.